



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 8**  
**DENVER, CO 80202-1129**  
**1595 Wynkoop Street**  
**Phone 800-227-8917**  
**<http://www.epa.gov/region08>**

JUL 30 2014

Ref: 8EPR-ER

**ACTION MEMORANDUM**

**SUBJECT:** Request for Funding and Approval of a Time-Critical Removal Action for the Crystal Mine, which is OU5 of the Basin Mining Area NPL Site, near the Town of Basin, Jefferson County, Montana

**FROM:** Duc Nguyen  
Federal On-Scene Coordinator

**THRU:** Laura Williams, Unit Leader  
Emergency Response

**TO:** David A. Ostrander, Director  
Emergency Response & Preparedness Program

Site ID#: K5

**I. PURPOSE**

The purpose of this Action Memorandum is to request and document approval of the time-critical removal action (TCRA) described herein for the Crystal Mine Site (Site) which is operable unit 5 (OU5) of the Basin Mining Area National Priorities List (NPL) Site near the Town of Basin in Jefferson County, Montana. This removal action is to remove heavy metals-contaminated sludge from two 25,000-gallon sediment retention ponds, whose berms are now in jeopardy of completely eroding and failing. If the ponds fail, land administered by the U.S. Forest Service (USFS) and Uncle Sam Gulch Creek (USG Creek), located directly below the lower pond outlet, will be significantly contaminated. Conditions at the Site present a threat to public health and the environment and meet the criteria for initiating a removal action under 40 CFR 300.415(b)(2) of the National Contingency Plan (NCP).

This removal action involves no nationally-significant or precedent-setting issues. This TCRA will not establish any precedent for how future response actions will be taken and will not commit the Environmental Protection Agency (EPA) to a course of action that could have a significant impact on future responses or resources.

## II. SITE CONDITIONS AND BACKGROUND

<b>Site Name:</b>	<b>Crystal Mine Site</b>
<b>Superfund Site ID (SSID):</b>	<b>K5</b>
<b>Operable Unit</b>	<b>OU 5</b>
<b>NRC Case Number:</b>	<b>N/A</b>
<b>CERCLIS Number:</b>	<b>MTD982572562</b>
<b>Site Location:</b>	<b>Basin, Jefferson County, Montana</b>
<b>Lat/Long:</b>	<b>N 46°20'51.05"/W112°15'42.72"</b>
<b>Potentially Responsible Party:</b>	<b>No viable, liable parties have been identified</b>
<b>NPL Status:</b>	<b>Final October 22, 1999</b>
<b>Planned Removal Start Date:</b>	<b>4<sup>th</sup> Quarter FY 2014</b>

The EPA added the Basin Mining Area Superfund Site to the NPL in October 1999 (CERCLIS No. MTD982572562) and subsequently divided the Site into six operable units.

- OU1 - The Town of Basin is located at the mouth of the watershed (OU2). The EPA completed the cleanup of mining-related impacts in the town in 2002.
- OU2 - The Basin Watershed included more than 300 abandoned hard rock mine sites located within 77-square-mile area from the headwaters of Basin and Cataract Creek to their confluence with the Boulder River.
- OU3 - Luttrell Repository is a joint mine waste repository shared by the State of Montana, the EPA, and the USFS. The Luttrell Repository is located at the top of the Basin Watershed, and also accepts mine waste from the Upper Tenmile Creek Mining Area Superfund Site.
- OU4 - Buckeye/Enterprise Mines, located within OU2.
- OU5 - Crystal Mine, located within OU2
- OU6 - Bullion Mine, located within OU2 and within 2 miles of Crystal Mine..

This time-critical removal action is proposed because the Crystal Mine Site, with its associated acid mine drainage (AMD), represent the greatest threat to the water quality in the entire Basin Watershed OU2.

### A. Site Description

#### 1. Removal Site Evaluation

In June 2013, a Site visit revealed that significant erosion had occurred throughout the area of the ponds. The berm of the lower of the two ponds is now in jeopardy of completely failing. A tear has developed in the liner and the soil is eroding under the pond liner at the discharge location. AMD water discharges from the lower adit of Crystal Mine at an average rate of 27 gallons per minute (gpm) directly into the two ponds. The untreated AMD water spills over the lower pond and flows onto U.S. Forest administered land before being intercepted by USG Creek, which is approximately 300 yards downstream from the on-site settling ponds.

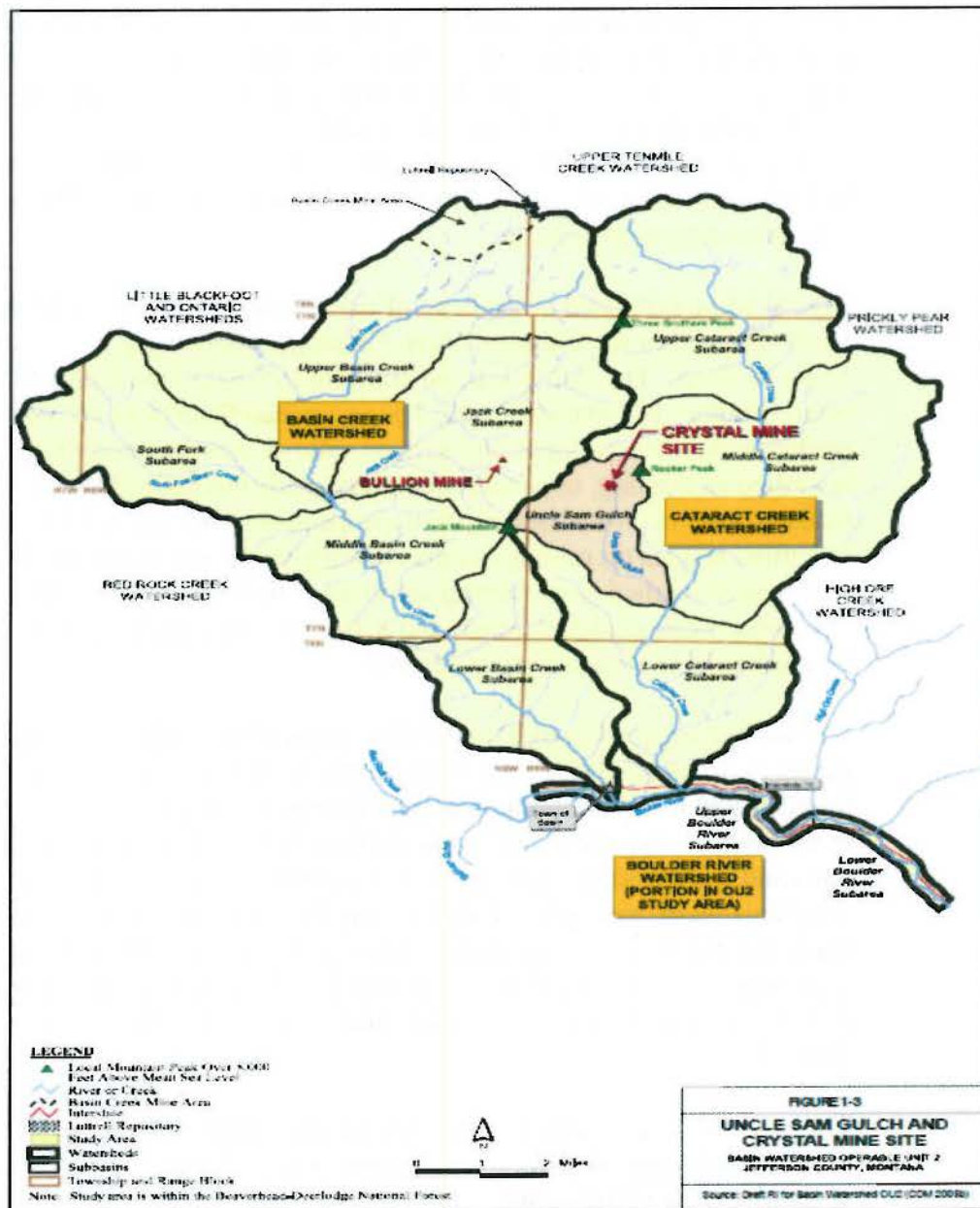
Due to the high snow pack, ongoing accelerated soil erosion, and severely deteriorated pond liners, especially at the lower pond outlet, there is a high potential of a catastrophic failure that could release a significant volume of AMD water (pH 2.6) and heavy metals-contaminated sludge onto land administered by USFS, and then into USG Creek (a tributary to Cataract Creek). This would result in the exposure of residents, recreational visitors and environmental receptors to high concentrations of harmful metals and also result in a much more difficult and expensive site-wide cleanup.

Crystal Mine is located at the head of Uncle Sam Gulch (T7N, R5W, Sections 18,19, 20) within the Cataract Creek Drainage, about eight miles north of the Town of Basin. The Site is located adjacent to Uncle Sam Gulch (USG) Creek, a small tributary to Cataract Creek. The watershed landforms consist of predominantly steep slopes and narrow valleys. Access throughout the watershed is limited to existing, unpaved, secondary roads maintained by the USFS. The roads are snow covered and typically impassible from late fall to early summer. The mine resides on mining claims encompassing approximately 40 acres, 22 of which are disturbed from mining activities. The Site is located between 7,640 feet (ft) above mean sea level (amsl) and 8,100 ft (amsl), and is surrounded by the Beaverhead-Deerlodge National Forest.

The surface expression of Crystal Mine is superimposed on an east-west trending subbasin drainage divide (at 8,100 feet amsl). The east end of this subbasin intercepts an incised subdrainage (USG) which is oriented north-south and drains to the south. USG Creek originates northeast of the Site from a series of alpine bogs and wet meadows. The creek flows north to south where it erodes and undercuts waste rock piles while forming the eastern edge of the Site. The stream reach parallel to the Site is slightly gaining in volume, relatively straight and approximately 1,100 feet long. The gradient along this reach is approximately 22 percent, or a vertical foot of elevation for every 4.6 linear feet of stream channel.

The principal vein minerals at the Site are crystalline quartz and fine-grained pyrite, which contain gold, silver, copper, lead and zinc. Pyrite (iron sulfide), sphalerite (zinc sulfide), and galena (lead sulfide) are the most abundant ore minerals in the mine. Gold is associated with pyrite, arsenopyrite and copper minerals. Silver is associated with tetrahedrite and galena.

The Site is now a significant source of AMD that is impacting water quality in USG Creek and Cataract Creek. Elevated concentrations of arsenic and trace metals (particularly antimony, aluminum, cadmium, copper, lead, selenium and zinc) are present in Site soils, mine discharge, and downstream surface water and sediment. The principal source of AMD is discharge from the lower Crystal adit and several springs within the mine area, which contribute to the total metal load in USG Creek downstream of Crystal Mine. USG Creek flows into Cataract Creek approximately two miles downstream of its confluence with the Crystal Mine discharge.



**Figure 1: Basin Watershed**

## 2. Physical Location

The Site is located on private (mineral patents) lands about six miles north of the Town of Basin in Jefferson County, Montana. The Site is located in the headwaters of Uncle Sam Gulch, a tributary of Cataract Creek. The Site resides on the northeast flank of Jack Mountain in Sections 18, 19 and 20 of T7N, R5W of the Montana Principal Meridian. All Site drainage eventually enters the Boulder River near Basin, Montana.

The Site is located within the Basin Watershed OU2, which encompasses an area of 77 square miles within the Boulder River Watershed and is located in the Beaverhead-Deer Lodge National Forest in the northern portion of Jefferson County, Montana. OU2 includes eight miles of the Boulder River and the entire Basin Creek and Cataract Creek watersheds. The majority of the land within the Basin Creek Watershed is managed by the USFS or U.S. Department of the Interior, Bureau of Land Management (BLM). The historic land use for claim properties in the watershed has been mining. Other land uses in the area consist of logging, grazing, recreational and residential. Although the watershed is sparsely populated, local residences are scattered along Basin and Jack creeks, with the Town of Basin at the mouth of the watershed. Water from these creeks recharges shallow alluvial aquifers which are a source of drinking water for many Basin residents and represents the primary human health risk pathway. No known potable water supply wells are located within a one-mile radius of the Site. Water from Basin Creek is also used for irrigation, supports fisheries, and ultimately enters the Boulder River. Neighboring residential areas are the Town of Boulder (approximately seven miles east and downstream of Basin), the City of Butte (more than 22 miles southwest of Basin), and the City of Helena (more than 25 miles northeast of Basin).

### **3. Site Characteristics**

The surface of the Site includes an east-west trending linear, previously mined, trench feature located on a subbasin drainage divide. The trench was an 800 to 1,000-foot-long excavation that the EPA lined and backfilled during the 2002 TCRA. Other features at the Site include numerous waste rock piles, twin ore bins that held material mined from the upper adit, five historic out-buildings, a visible portal leading to the lower underground workings, remnants of an old trestle, several ore chutes and two lined settling ponds built over a waste rock dump. The slope below the east end of the trench is steep (greater than 25 percent) and covered with waste rock. Waters from USG Creek erode and undercut waste rock piles while forming the eastern edge of the active mine site.

The majority of the Site is barren of top soil and vegetation due to mining impacts. Mineralized waste rock and decomposed granite constitute the soil surface. This material is easily eroded and highly mobile during rainfall and surface runoff events, as evidenced by numerous erosion rills. In the high elevations associated with the Site, groundwater is present in small, unconsolidated glacial/alluvial deposits as well as in the fractured bedrock.

Shallow groundwater flow generally follows surface topography. Groundwater is not developed for drinking at or near the Site. Surface water associated with the drainage basin and wetlands north of the trench area infiltrates the shallow soils, migrates through fractured bedrock and intercepts the lower underground mine workings. This water moves laterally through the workings, discharges from the lower adit at an average rate of approximately 26 gpm, and intercepts USG Creek



approximately 300 yards downstream from the onsite settling ponds. EPA Region 8's Remedial Program will conduct a treatability study in the summer of 2014, and as part of that study, the AMD from the mine will be directed away from the ponds into USG Creek. This will allow the ponds to dry out somewhat before sludge removal begins as part of this 2014-2015 TCRA. See Figure 2 below.



**Figure 2:** Crystal Mine Conceptual Site Plan

As previously noted, the two lined ponds are remnants of a pilot project to treat AMD. In the early 1990s through an interagency agreement, the EPA and U.S. Department of Energy introduced a treatment technology at the Site, treating effluent from the lower adit. Effluent draining from the lower adit of the Crystal Mine was piped to an Aqua-Fix® system. The system used a flywheel to inject quicklime (calcium oxide) into the mine adit discharge, where it was allowed to mix prior to being discharged into one of two primary settling ponds. The two 25,000-gallon, high-density polyethylene (HDPE) lined primary settling ponds provided approximately one hour of retention time during which solid metal hydroxide sludge formed and settled out. Effluent from the initial settling ponds drained into a secondary 25,000-gallon, HDPE-lined settling pond which provided additional retention time for settling of the metal hydroxide sludge. Effluent from the secondary settling pond discharged directly into USG Creek. The Aqua-Fix

treatment technology was operated at the Site for two years beginning in 1994. While operational, the system raised the effluent pH and was able to effectively treat or reduce the concentrations of the monitored constituents (lead, aluminum, zinc, and copper) 36 to 70 percent of the time over a 2-year period. However, the project resulted in a number of challenges which required a final settling pond with a larger volume capacity (100,000 gallons) and a longer retention time (60 hours). Because of physical Site limitations, the pilot project was shut down and partially dismantled, leaving the sediment retention ponds in place with exposed contaminated sludge and AMD. Now the pond liners are 20 years old and beginning to fail (see Figures 3 and 4).



**Figure 3:** Second Pond SE corner discharge point onto USFS administered land.





**Figure 4:** Pond's liner condition and erosion.

**4. Release or Threatened Release into the Environment of a Hazardous Substance, Pollutant or Contaminant**

The AMD discharge from the retention ponds carries substantial concentrations of antimony, arsenic, cadmium, copper, iron, lead, manganese, nickel, selenium and zinc exceeding state and federal drinking water standards and aquatic life standards. The discharge adversely influences water quality downstream to USG Creek and the Cataract Creek drainage.

These heavy metals (arsenic, cadmium, copper, lead and zinc) coming from the adit portal and, subsequently, the retention ponds are "hazardous substances" as defined by Section 101 (14) of the Comprehensive Environmental, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. Section 9601(14). Accordingly, the potential for a release of a considerable amount of mine-contaminated sludge from two settling and retention ponds poses an imminent and substantial threat to public health or the environment and to USFS administered lands and other private properties.



**Crystal Mine Adit Discharge Water Quality Summary (CDM, 2005b)**

Water Quality Constituent	Maximum	Minimum
Total discharge (cfs)	0.15	0.04
pH	3.4	3.4
Arsenic, total (µg/L)	9,910	461
Arsenic, dissolved (µg/L)	186	186
Cadmium, total (µg/L)	1,010	706
Cadmium, dissolved (µg/L)	729	729
Copper, total (µg/L)	26,700	11,800
Copper, dissolved (µg/L)	11,900	11,900
Lead, total (µg/L)	425	154
Lead, dissolved (µg/L)	149	149
Mercury, total (µg/L)	---	---
Mercury, dissolved (µg/L)	2U	2U
Zinc, total (mg/L)	84,300	63,600
Zinc, dissolved (mg/L)	64,000	64,000
SO <sub>4</sub> (mg/L)	468	468

**Notes:**

CDM (2005b) Table 7.5-2

U = The material was not detected above the level of the associated value (quantification of detection limit).

--- = No data.

**Bolded** values indicate exceedance of human health and ecological risk-based benchmarks set in 2005.

## Arsenic

Large doses of arsenic may be acutely fatal. Symptoms include fever, loss of appetite, enlarged liver and heart rhythm abnormalities. Sensory loss in the peripheral nervous system may also occur. Chronic exposure to arsenic generally results in skin lesions, liver injury and peripheral vascular disease. The peripheral vascular disease may progress to endarteritis obliterans and gangrene of the lower extremities (blackfoot disease). Arsenic is a human carcinogen based on observation of increased lung cancer mortality due to inhalation exposure and increased skin cancer in individuals exposed to arsenic via drinking water.

Arsenic poisoning can be a toxic syndrome among domestic animals. Arsenic causes hyperemia and edema of the gastrointestinal tract, hemorrhage of the cardiac serosal surfaces and peritoneum, and pulmonary congestion and edema. It may cause liver necrosis.

## Lead

Lead is a hazardous substance as defined by Section 101(14) of CERCLA. Lead is also classified as a B2 carcinogen by EPA. This classification is the result of sufficient animal studies determining that these compounds are probable human

carcinogens. Lead can enter the body via ingestion and inhalation. Children appear to be the segment of the population at greatest risk from toxic effects of lead. Initially, lead travels in the blood to the soft tissues (heart, liver, kidney, brain, etc.), then it gradually redistributes to the bones and teeth where it tends to remain. The most serious effects associated with markedly elevated blood lead levels include neurotoxic effects such as irreversible brain damage. Children have exhibited nerve damage, permanent mental retardation, colic, anemia, brain damage, and death.

Lead is ubiquitous in the environment. Although bioaccumulation is known to occur, and lead is found in the tissue of many wild animals, including birds, mammals, fishes, and invertebrates, the most publicized effects of lead have been on the impact of ingestion of lead by waterfowl. Acute and chronic lead toxicity have been demonstrated as a definite threat to bird populations. There is also evidence that lead at high concentrations can eliminate populations of bacteria and fungi on leaf surfaces and in soil. Many of the microorganisms play key roles in the decomposer food chain.

### **Zinc**

Total zinc concentrations in the Crystal adit channel range from 40,900 µg/L to 55,400 µg/L. Acute toxicity is similar for freshwater fish and invertebrates. In many types of aquatic plants and animals, growth, survival and reproduction can all be adversely affected by elevated zinc levels. Some researchers have speculated that exposure to excessive amounts of zinc may constitute a hazard to animals. Laboratory studies and findings in animals living near lead-zinc smelters suggest that excessive exposure to zinc may produce bone changes, joint afflictions and lameness.

### **Cadmium**

Cadmium is found in the Crystal Mine channel to range from 318 µg/L to 412 µg/L. Laboratory experiments suggest that cadmium may have adverse effects on reproduction in fish at levels present in lightly to moderately polluted waters. Cadmium is highly toxic to wildlife; it is cancer-causing and teratogenic and potentially mutation-causing, with severe sublethal and lethal effects at low environmental concentrations. It bio-accumulates at all trophic levels, accumulating in the livers and kidneys of fish. Crustaceans appear to be more sensitive to cadmium than fish and mollusks. Cadmium can be toxic to plants at lower soil concentrations than other heavy metals and is more readily taken up than other metals.

### **Copper**

Copper concentrations range as high as 13,300 µg/L. Copper produces acute toxicity in freshwater animals and data are available for species in 41 Genera. Fish and invertebrate species seem to be about equally sensitive to the chronic

toxicity of copper. Copper is highly toxic in aquatic environments and has effects in fish, invertebrates and amphibians. Copper will bio-concentrate in many different organs in fish (potential low, however) and mollusks. Copper sulfates and other copper compounds are algacides, with sensitive algae potentially affected by free copper at low ppb concentrations.

#### **4. NPL Status**

The Basin Mining Area was put on the National Priorities List on October 22, 1999. The Crystal Mine is within the NPL site and is designated as OU5.

#### **5. Maps, Pictures and Other Graphic Representations**

Location and Site maps are included as Attachments 1.

### **B. Other Actions to Date**

#### **1. Previous Actions**

Several previous response actions have occurred at the Crystal Mine, described as follows:

- A treatment demonstration project was conducted from 1994 to 1996 and consisted of a semi-active lime treatment process focused directly on the treatment of AMD discharging from the lower adit (MSE, 1998).
- A removal action was performed in 2002–2004 to mitigate surface recharge to the underground workings of the mine in an attempt to reduce the volume of AMD discharging from the lower adit. The removal action involved placement of a liner and clean fill material over the Crystal trench.

#### **2. Current Actions**

- A public meeting was held on March 19, 2014, at the Basin School House to provide information on the RI/FS reports, the proposed plans and EPA's preferred alternatives for the Crystal and Bullion mine sites, OUs 5 and 6 of the Basin Mining Area Superfund Site. An interim ROD, *Draft Interim Record of Decision-May 2014*, for Crystal Mine has been drafted and is currently under Agency review.
- EPA is working with the USFS to develop an Interagency Agreement or Memorandum of Understanding for the Bullion and Crystal sites. The document will address EPA/EPA contractor's use of USFS roads, impacts to USFS administered lands, and possible future use of borrow material from USFS lands.



**C. Federal, State and Local Authorities' Roles**

**1. Federal, State and Local Actions to Date**

Both the USFS and Montana Department of Environmental Quality (MDEQ) have supported the proposed removal action.

**2. Potential for Continued State/Local Response**

Neither the state nor the local authorities have the resources to conduct the proposed removal action at this Site. The state and local constituents will continue to be involved in the removal planning and will be kept apprised of all activities of this removal action.

**III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES**

Conditions at the Site present a threat to public health or welfare or the environment, and meet the criteria for initiating a removal action under 40 CFR section 300.415(b)(2) of the NCP.

EPA has considered all the factors described in 40 CFR 300.415(b)(2) of the NCP and determined that the following factors apply at the Site.

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;*

The potential release of 50,000 gallons of contaminated sludge and AMD from two retention ponds would carry substantial concentrations of antimony, arsenic, cadmium, copper, iron, lead, manganese, nickel, selenium and zinc, exceeding state and federal drinking water standards and aquatic life standards. Humans and the surrounding surface and aquatic environment could be adversely affected by heavy metals released from the Site. In addition, human consumption of fish taken from river segment(s) below the creek/river confluence could result in adverse human exposure to Site-released contaminants.

- (ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;*

The drinking water supply to the Town of Basin could be adversely impacted in the event of failure of the retention ponds potentially releasing 50,000 gallons of elevated concentrations of heavy metals and acidic liquids from the Site. In addition, the release will have a deleterious effect on downstream aquatic life.

- (iv) High levels of hazardous substances or pollutants or contaminants, largely at or near the surface, that may migrate;*

A recent Site visit revealed that significant erosion has occurred at the Site. The lower of two retention ponds is now in jeopardy of completely eroding. If the ponds do fail, due to heavy run-

off and on-going accelerated soil erosion, not only would land administered by the USFS directly below the lower pond be significantly contaminated, but also the Basin Watershed would be impacted by high concentrations of heavy metals. These heavy metals are “hazardous substances” as defined by Section 101(14) of CERCLA, 42 U.S.C. Section 9601(14). Release of these contaminants from the Site has been documented in the aforementioned studies and reports.

*(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;*

Eroded mine-contaminated sludge and acid discharge water from two retention ponds could migrate downslope as a result of snowmelt/precipitation-induced overland flow, onto the USFS lands, and into Uncle Sam Gulch Creek.

*(vii) The availability of other appropriate federal or state response mechanisms to respond to the release;*

No other agency has the resources to respond to this release.

*(vii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment.*

Contamination from this Site could potentially enter the food chain via aquatic life or by human consumption of fish taken from the Basin Creek Watershed.

#### **IV. EXEMPTION FROM STATUTORY LIMITS**

Not applicable.

#### **V. PROPOSED ACTIONS AND ESTIMATED COSTS**

##### **A. Proposed Actions**

##### **1. Proposed Action Description**

The removal action specified in this Action Memorandum includes response actions for two retention ponds and the pond’s AMD water. This action is intended to be protective of human health and the environment until the final remedy for the Crystal Mine Site can be implemented.

- Infrastructure - Road improvements will be performed to facilitate the safe movement of heavy equipment to and around the Site.
- AMD Treatment - water in the ponds will be treated with caustic (NaOH) or lime (CaCO<sub>3</sub>) to neutralize the pH and subsequently discharged directly to Uncle Sam Gulch Creek.
- Removal of Sediment Retention Ponds – Contaminated sludges from the ponds will be removed and hauled to Luttrell Repository.

**2. Contribution to Remedial Performance**

The effort will, to the extent practical, contribute to any future remedial effort at the Site. By removing the sludges from the retention ponds, the threat of a catastrophic failure of the existing retention ponds releasing 50,000 gallons of contaminated mine water will be eliminated thus reducing the mass metals loading on the entire Basin Watershed and on USFS administered lands.

**3. Engineering Evaluation/Cost Analysis (EE/CA)**

An EE/CA is not required for a time-critical removal action.

**4. Applicable or Relevant and Appropriate Requirements (ARARs)**

Removal actions conducted under CERCLA are required, to the extent practicable considering the exigencies of the situation, to attain applicable or relevant and appropriate requirements (ARARs). In determining whether compliance with an ARAR is practicable, the lead agency may consider appropriate factors including the urgency of the situation and the scope of the removal action to be conducted. A table containing potential Site-specific ARARs is provided as Attachment 4 to this Action Memorandum.

**5. Project Schedule**

The removal action is planned to be completed by the end of 2014.

**B. Estimated Costs\***

Extramural Costs:

Total ERRs (Construction and Disposal	\$230,000
START 4 (Design and Removal Support	\$30,000
20% Contingency	\$52,000
Total Extramural Costs	\$312,000
<b>Removal Project Ceiling</b>	<b>\$312,000</b>

\*EPA direct and indirect costs, although cost recoverable, do not count toward the removal ceiling for this removal action. Liable parties may be held financially responsible for costs incurred by the EPA as set forth in Section 107 of CERCLA.

**VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN**

A delay in action or no action at this Site would create public concern, increase the likelihood of a catastrophic release of AMD-contaminated waters that could adversely impact drinking water and increase the actual or potential threat to public health and/or the environment.

A sudden release of the heavy metal impacted retention ponds is likely imminent if the proposed



removal action does not occur. The sudden release of an estimated 50,000 gallons of contaminated water is a threat to water quality in the Basin Watershed (OU2) and to USFS administered lands and other private properties. Other risks should action be delayed or not taken include:

- Risk of public criticism if a release occurs and EPA did not act in a timely manner to prevent it;
- Risk of damage to downstream properties owned by the USFS and private property owners if a release of a considerable amount of mine contaminated sludge occurs.

Human consumption of fish taken from river segments below the creek/river confluence could result in adverse human exposure to Site-released contaminants. The release of AMD impacted waters would have both acute and chronic impacts on aquatic ecosystems, resulting in the destruction of habitat.

## **VII OUTSTANDING POLICY ISSUES**

None

## **VIII. ENFORCEMENT**

A separate Enforcement Addendum has been prepared providing a confidential summary of current and potential future enforcement actions.

## **VIII. RECOMMENDATION**

This decision document represents the selected removal action for the Crystal Mine Site near Basin in Jefferson County, Montana, developed in accordance with CERCLA as amended and is not inconsistent with the NCP. This decision is based on the administrative record for the Site.

Conditions at the Site meet the NCP Section 300.415(b)(2) criteria for a removal action, and I recommend your approval of the proposed removal action. The removal project ceiling, if approved, will be \$312,000; this amount will be funded from the Regional removal allowance.

Approve: David A. Ostrander

Date: 7/30/2014

David A. Ostrander  
Director  
Emergency Response & Preparedness

Disapprove: \_\_\_\_\_

Date: \_\_\_\_\_

David A. Ostrander  
Director  
Emergency Response & Preparedness

## **SUPPLEMENTAL DOCUMENTS**

Support/reference documents which may be helpful to the reader and/or have been cited in the report may be found in the administrative record file located at:

U.S. EPA, Region 8 Montana Office  
Federal Building  
10 West 15th Street, Suite 3200  
Helena, MT 59626  
406-457-5000  
866-457-2690 (toll free)

- Attachment 1: Action Memorandum – April 12, 2000
- Attachment 2: Crystal Mine Operable Unit 5 – Interim Record of Decision (CD attached)
- Attachment 3: Crystal Mine Water Analytical Results
- Attachment 4: ARARs

Attachment 1

## Action Memorandum – April 12, 2000



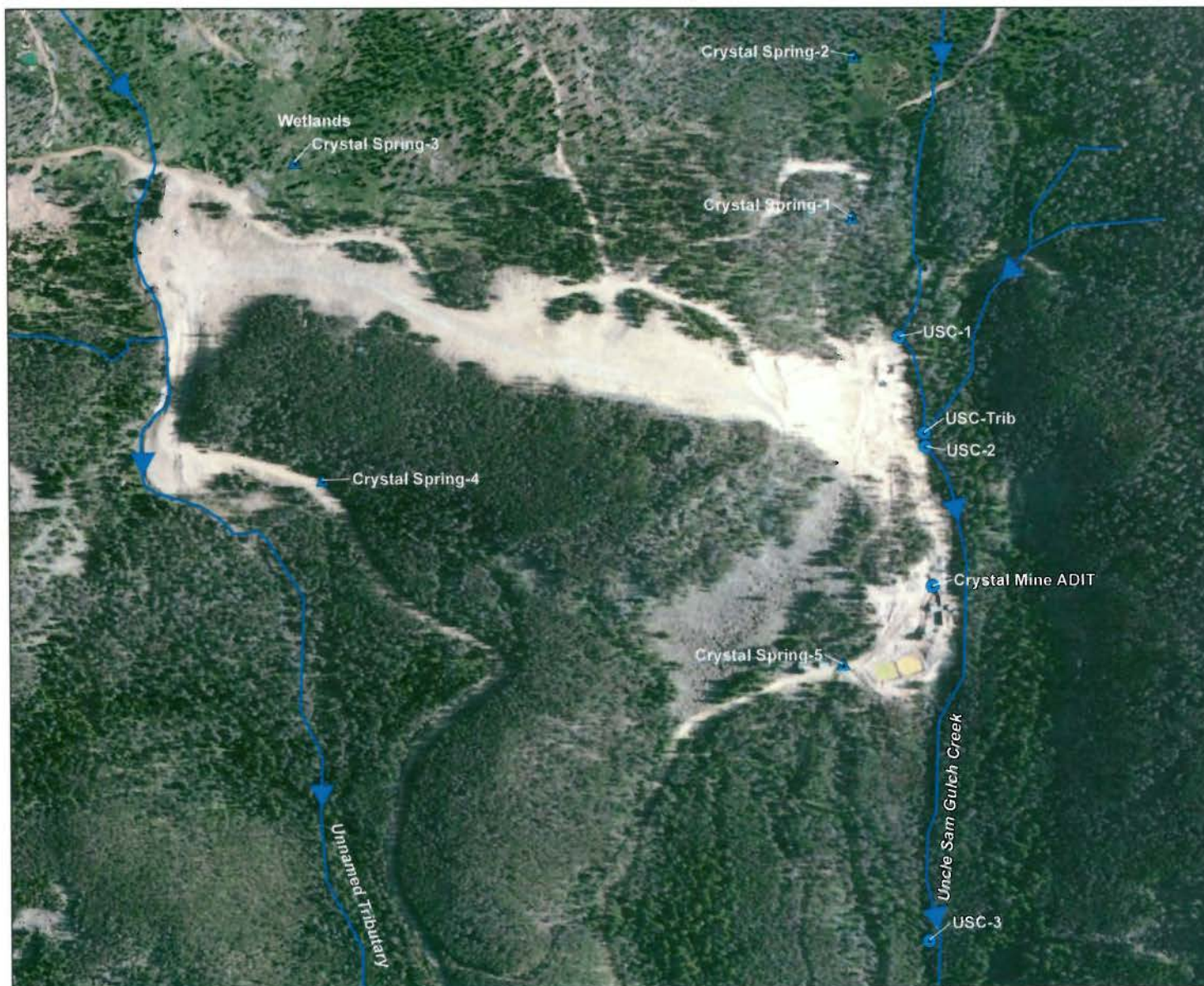
Attachment 2

## Interim Record of Decision – May 2014

(CD attached)

Attachment 3

# Crystal Mine Water Analytical Results



**LEGEND**

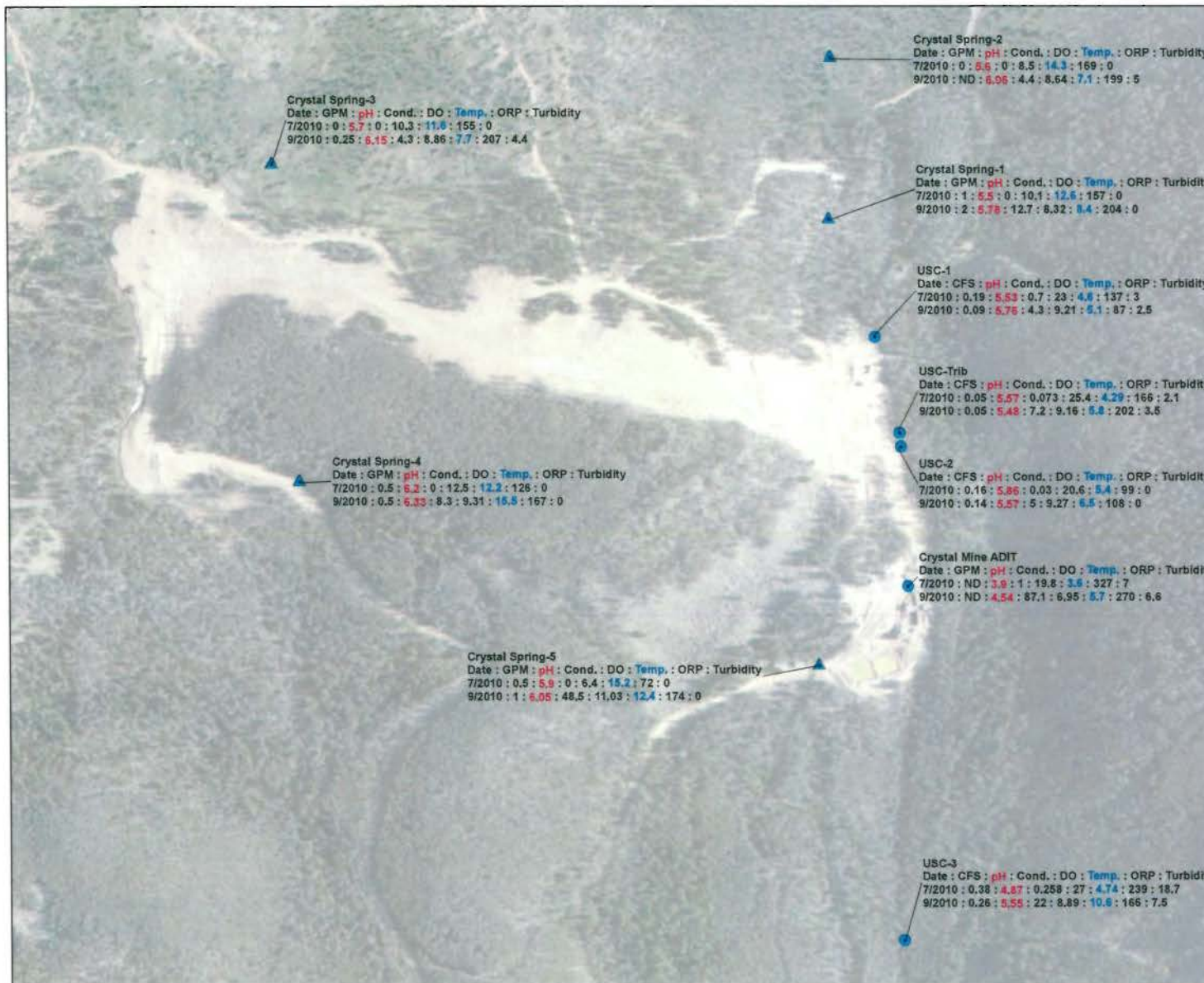
- Stream Sample Location
- ▲ Spring Sample Location
- Digitized/DEM Generated Streams

**Notes:**  
 1. Area of interest subject to change.  
 2. 2011 Imagery - ArcGIS Streaming Map Service.



**FIGURE 3-2**  
**Creek and Spring Sampling Locations**  
 in Uncle Sam Gulch  
 Crystal Mine OU5 Remedial Investigation



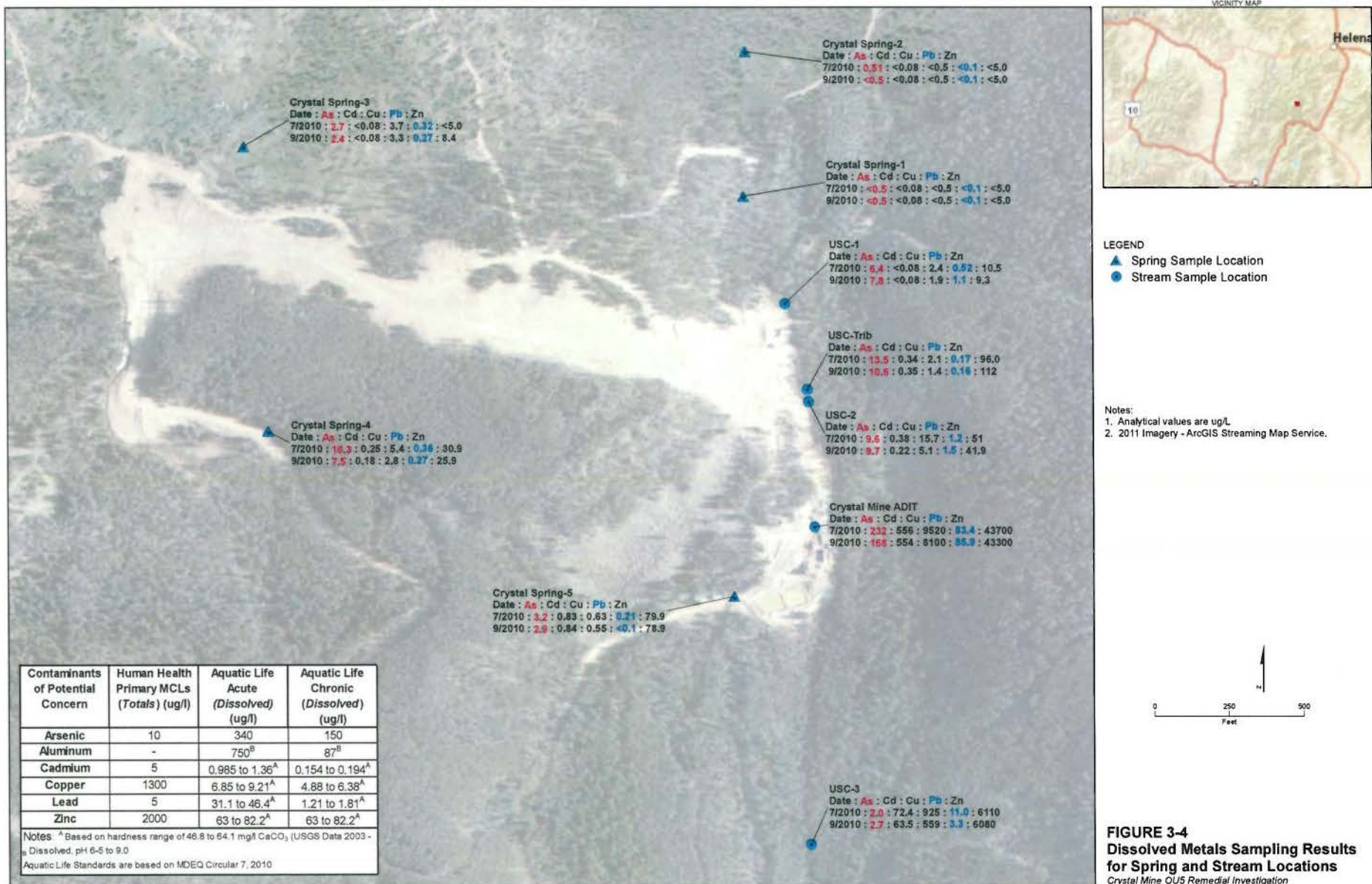


**LEGEND**  
▲ Spring Sample Location  
● Stream Sample Location

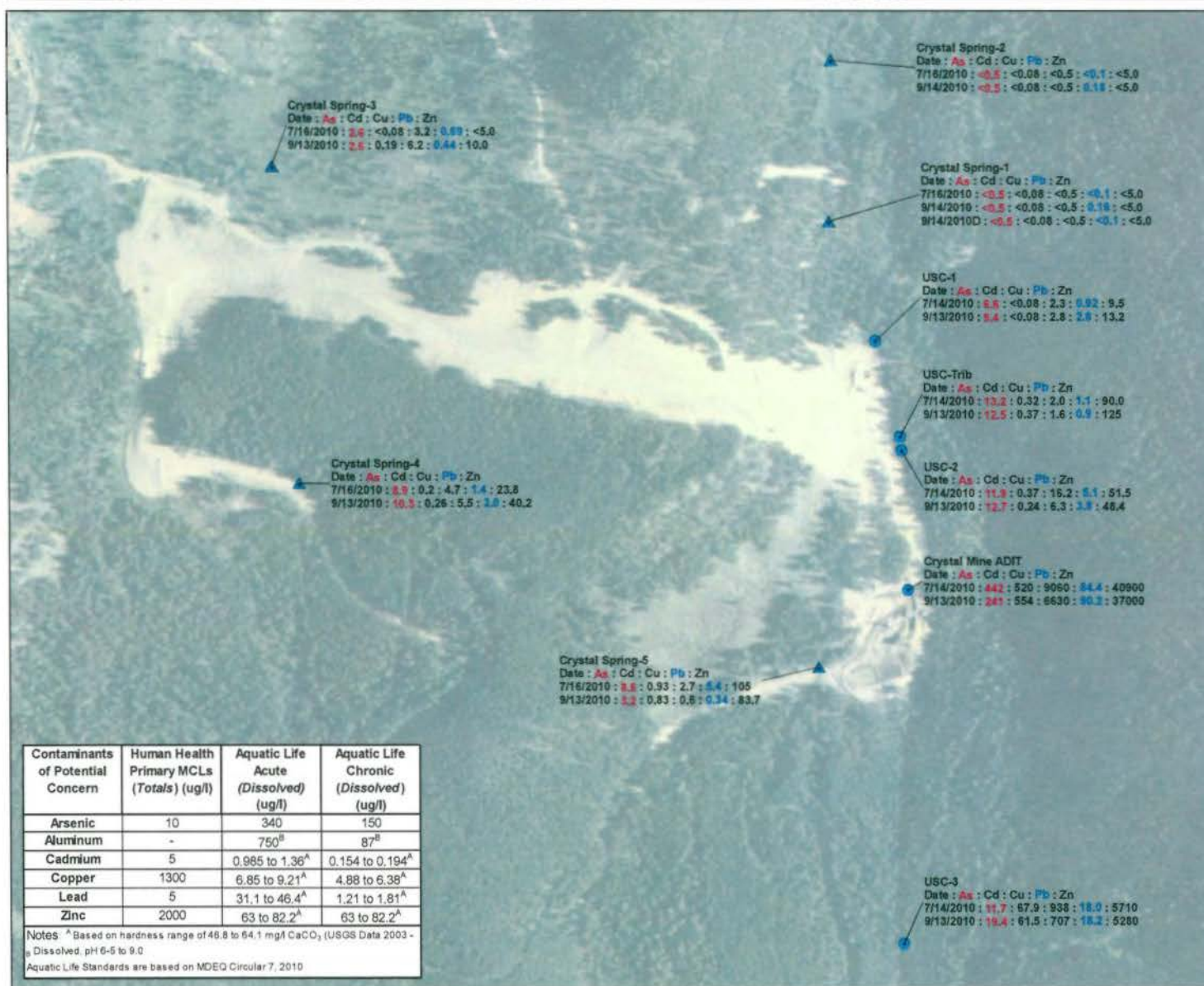
**Notes:**  
Conductivity =  $\mu\text{S}/\text{cm}$   
DO =  $\text{mg}/\text{L}$   
Temperature =  $^{\circ}\text{C}$   
ORP = Oxidation Reduction Potential (mV)  
Turbidity = NTU  
CFS = Cubic Feet per Second  
July Dissolved Oxygen (DO) values are unreliable  
2011 Imagery - ArcGIS Streaming Map Service.



**FIGURE 3-3**  
**Field Parameter Plotted at**  
**Sampling Location**  
Crystal Mine OUS Remedial Investigation

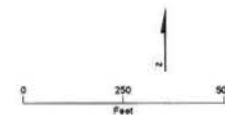






**LEGEND**  
 Spring Sample Location  
 Stream Sample Location

Notes:  
 1. Analytical values are ug/l  
 2. 2009 NAIP Orthophoto



**FIGURE 3-4a**  
**Total Metals Sampling Results**  
 for Spring and Stream Locations  
 Crystal Mine OUS Remedial Investigation

TABLE 3-10  
Crystal Mine Water Quality Results – Validated

Site	Date Sample Collected	Total Metals (µg/L)																Dissolved Metals (µg/L)												Anions (mg/L)			Alkalinity (mg/L)		
		Al	Sb	As	Cd	Ca	Cu	Fe	Pb	Mg	Mn	Ni	K	Se	Ag	Na	Tl	Zn	Al	Sb	As	Cd	Cu	Fe	Pb	Mn	Ni	Se	Ag	Tl	Zn	Cl- F	SO <sub>4</sub> <sup>2-</sup>	CaCO <sub>3</sub>	Total
Crystal Mine Adit	7/14/2010	7,630	5.0	442	520	57,400	9060	47,700	84.4	16,000	10,100	34.3	1470	1.1	0.5U	3,320	0.1U	40,900	7,840	2.3	232	556	9,520	49,100	83.4	10,700	36.6	1.2	0.5U	0.1U	43,700	1.0U	461	5.0U	5.0U
	9/13/2010	6,080	3.2	241	554	56,200	6630	53,000	90.2	15,600	11,900	33.0	1510	0.72	0.5U	3,550	0.1U	37,000	5,970	2.7	168	554	8,100	54,000	85.9	11,300	33.2	1.3	0.5U	0.1U	43,300	1.0U	475	5.0U	5.0U
Crystal Spring 1	7/16/2010	9.1	0.5U	0.5U	0.08U	1,590	0.5U	20.0U	0.1U	255	0.5U	0.5U	265	0.5U	0.5U	1,640	0.1U	5.0U	6.1	0.5U	0.5U	0.08U	0.5U	20.0U	0.1U	1.7**	0.5U	0.5U	0.5U	0.1U	5.0U	1.0U	5.0U	8.4	8.4
	9/14/2010	9.8	0.5U	0.5U	0.08U	2,020	0.5U	20.0U	0.16	304	0.60	0.5U	439	0.5U	0.5U	1,880	0.1U	5.0U	9.1	0.5U	0.5U	0.08U	0.5U	20.0U	0.1U	0.5U	0.5U	0.5U	0.69	0.1U	5.0U	1.0U	5.0U	9.7	9.7
	9/14/2010*	9.5	0.5U	0.5U	0.08U	1,950	0.5U	20.0U	0.1U	301	0.54	0.89	419	0.5U	0.5U	1,830	0.1U	5.0U	8.2	0.5U	0.5U	0.08U	0.5U	20.0U	0.1U	0.5U	0.5U	0.5U	0.5U	0.1U	5.0U	1.0U	5.0U	9.6	9.6
Crystal Spring 2	7/16/2010	10.8	0.5U	0.5U	0.08U	2,600	0.5U	20.0U	0.1U	412	0.5U	0.5U	299	0.5U	0.5U	1,980	0.1U	5.0U	4.3	0.5U	0.51	0.08U	0.5U	20.0U	0.1U	1.6**	0.5U	0.5U	0.5U	0.1U	5.0U	1.0U	5.0U	12.0	12.0
	9/14/2010	21.9	0.5U	0.5U	0.08U	3,170	0.5U	20.0U	0.18	473	---	0.5U	517	0.5U	0.5U	2,120	0.1U	5.0U	5.5	0.5U	0.5U	0.08U	0.5U	20.0U	0.1U	0.5U	0.5U	0.5U	0.5U	0.1U	5.0U	1.0U	5.0U	12.6	12.6
Crystal Spring 3	7/16/2010	207	0.5U	2.6	0.08U	3,660	3.2	149	0.69	562	23.1	0.5U	497	0.5U	0.5U	1,790	0.1U	5.0U	193	0.5U	2.7	0.08U	3.7	138	0.32	23	0.5U	0.5U	0.5U	0.1U	5.0U	1.0U	5.0U	13.4	13.4
	9/13/2010	247	0.5U	2.6	0.19	4,400	6.2	182	0.44	678	12.6	0.59	465	0.5U	0.5U	1,970	0.1U	10.0	198	0.5U	2.4	0.08U	3.3	136	0.27	9.2	0.99	0.5U	0.5U	0.1U	8.4	1.0U	5.0U	13.6	13.6
Crystal Spring 4	7/16/2010	36.0	2.3	8.9	0.2	5,680	4.7	20.0U	1.4	1,060	1.8	0.5U	804	0.5U	0.5U	1,930	0.1U	23.8	6.5	3.0	10.3	0.25	5.4	20.0U	0.36	3**	0.5U	0.5U	0.5U	0.1U	30.9	1.0U	5.0U	22.3	22.3
	9/13/2010	52.9	2.5	10.3	0.26	6,900	5.5	67	2.0	1,250	4.5	0.5U	1000	0.5U	0.5U	2,340	0.1U	40.2	7.7	1.9	7.5	0.18	2.8	20.0U	0.27**	2.0	0.5U	0.5U	0.5U	0.1U	25.9	1.0U	5.0U	25.2	25.2
Crystal Spring 5	7/16/2010	306	0.52	8.6	0.93	46,700	2.7	344	5.4	8,410	7.5	0.5U	1260	0.5U	0.5U	4,040	0.1U	105	9.8	0.5U	3.2	0.83	0.63	20.0U	0.21	1.9**	0.5U	0.5U	0.5U	0.1U	79.9	1.3	135	25.7	25.7
	9/13/2010	19.8	0.5U	3.2	0.83	59,600	0.6	20.0U	0.34	10,100	0.63	0.55	1530	0.5U	0.5U	4,990	0.1U	83.7	5.4	0.5U	2.9	0.84	0.55	20.0U	0.1U	0.5U	0.5U	0.5U	0.1U	78.9	1.0U	182	28.1	28.1	
USC-1	7/14/2010	41.8	0.5U	6.6	0.08U	3,290	2.3	174	0.92	574	15.5	0.5U	287	0.5U	0.5U	1,980	0.1U	9.5	37.2	0.5U	6.4	0.08U	2.4	141	0.52	15.1**	0.5U	0.5U	0.5U	0.1U	10.5	1.0U	5.0U	13.2	13.2
	9/13/2010	58.1	0.5U	9.4	0.08U	4,220	2.8	272	2.8	669	27.3	0.5U	424	0.5U	0.5U	2,300	0.1U	13.2	32.9	0.5U	7.8	0.08U	1.9	214	1.1**	24.5	0.5U	0.5U	0.5U	0.1U	9.3	1.0U	5.0U	16.3	16.3
USC-2	7/14/2010	58.9	0.64	11.9	0.37	3,810	16.2	173	5.1	675	18.1	1.6	324	0.5U	0.5U	1,880	0.1U	51.5	39.2	0.55	9.6	0.38	15.7	105	1.2	14**	0.5U	0.5U	0.5U	0.1U	51	1.0U	5.0U	14.1	14.1
	9/13/2010	53.4	0.58	12.7	0.24	5,140	6.3	224	3.8	878	22.6	0.78	500	0.5U	0.5U	2,410	0.1U	48.4	30.2	0.58	9.7	0.22	5.1	144	1.5**	19.3	0.5U	0.5U	0.5U	0.1U	41.9	1.0U	5.0U	18.5	18.5
USC-3	7/14/2010	741	1.2	11.7	67.9	15,200	938	1,140	18.0	3,470	1,390	5.1	694	0.5U	0.5U	2,240	0.1U	5,710	391	1.1	2.0	72.4	925	492	11.0	1,390	5.3	0.5U	0.5U	0.1U	6,110	1.0U	72.2	5.0U	5.0U
	9/13/2010	663	1.4	19.4	61.5	20,400	707	1,080	18.2	4,250	1,260	5.1	900	0.5U	0.5U	2,740	0.1U	5,280	89.8	1.1	2.7	63.5	559	414	3.3**	1,400	4.7	0.5U	0.5U	0.1U	6,080	1.0U	79.2	5.9	5.9
USC-Trib	7/14/2010	16.4	0.5U	13.2	0.32	5,350	2.0	20.0U	1.1	969	5.4	0.5U	335	0.5U	0.5U	1,700	0.1U	90.0	8.0	0.5U	13.5	0.34	2.1	20.0U	0.17	4.7**	0.5U	0.5U	0.5U	0.1U	96.0	1.0U	5.0U	21.2	21.2
	9/13/2010	16.3	0.5U	12.5	0.37	8,140	1.6	57.6	0.9	1,480	9.9	0.5U	588	0.5U	0.5U	2,120	0.1U	125	6.8	0.5U	10.6	0.35	1.4	20.0U	0.16**	7.3	0.5U	0.5U	0.5U	0.1U	112	1.0U	5.0U	27.6	27.6
Crystal Blank	9/14/2010	4.0U	0.5U	0.5U	0.08U	34.6	0.5U	20.0U	0.1U	5.0U	0.5U	0.5U	95.6	0.5U	0.5U	1,090	0.1U	5.0U	4.0U	0.5U	0.5U	0.08U	0.5U	20.0U	0.34	0.5U	0.5U	0.5U	0.5U	0.1U	5.0U	1.0U	5.0U	5.0U	5.0U
Screening Levels*		87	5.6	5	0.097	2.85	300	0.55		120	16.1		1	0.37		0.24	37		87	5.6	5	0.097	2.85	300	0.55	120	16.1	1	0.37	0.24	37				

## Notes:

All samples analyzed without qualifiers are of the Highest Quality (Enforcement Quality) as defined by CFR SSI Data Management/Data Validation Plan (PTI, 1992 with revision [1993], and addendum [2000])

Bolded values represent exceedance of constituent screening levels.

\* Elevated levels of dissolved manganese in lab method blank and field blank

\* Elevated level of dissolved lead in field blank

\* Elevated level of total sodium in field blank

\* Elevated level of dissolved aluminum in field blank

\* Highest Quality (Enforcement Quality) as defined by CFR SSI Data Management/Data Validation Plan (PTI 1992, with revision [1993], and addendum [2000])

\* No Analytical Limitations

\* Screening Levels refer to Tables 1-5 through 1-7

Attachment 4

## **ARARs**

Montana Solid Waste Requirements	MCA 75-10-212	<b>Applicable</b>	Prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted.	The listed requirements apply to the offsite transportation of solid wastes to disposal facilities, should that remedial option be chosen.
	ARM 17.50.523		Specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.	